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Biomimetic chemical systems under mechanical stress - from the functional molecule to the living cell

Initiative: Freigeist-Fellowships

Bewilligung: 03.07.2017

Laufzeit: 5 Jahre

Projekt-Website: https://www.dwi.rwth-aachen.de/person/dr-robert-goestl

Living cells and tissues are constantly subjected to mechanical stress and wear stimulating biological processes, such as the signaling of pain. Researchers strive to explore these biomechanical interactions but are confronted with a lack of tools to visualize stress from within the cell up to the tissue scale. The goal of this project is to develop molecular moieties by synthetic chemistry that act as predetermined breaking points either sending out an optical signal or initiating a biochemical reaction once subjected to stress. This will allow the spatial and directional optical resolution as well as the harnessing of force effects down to the molecular level. Initially, the optical probes will be incorporated into cell-like polymer architectures that resemble certain features of cells. This will not only allow the controlled benchmarking of the probes but moreover to learn about the response of these cell-like systems to mechanical stress. Subsequently, employing the optical stress-sensors in living cells will elucidate mechanical cellular responses in a much more complex, natural environment. Beyond the sensing of stresses, the initiation of biochemical reactions in cell-like nanoreactors employing force-cleavable protecting groups will lead to bioinspired materials that can perform functions nature has not yet achieved.

Projektbeteiligte

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Open Access-Publikationen

Anti-Stokes Stress Sensing: Mechanochemical Activation of Triplet Triplet Annihilation Photon Upconversion
Fractography of poly(N-isopropylacrylamide) hydrogel networks crosslinked with mechanofluorophores using confocal laser scanning microscopy.
Mechanochemical bond scission for the activation of drugs
Multicolor Mechanofluorophores for the Quantitative Detection of Covalent Bond Scission in Polymers
Mechanoresponsive Carbamoyloximes for the Activation of Secondary Amines in Polymers

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Es werden die Institutionen genannt, an denen das Vorhaben durchgeführt wurde, und nicht die aktuelle Adresse.